

U.S. DEPARTMENT OF COMMERCE  
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY  
(formerly National Bureau of Standards)  
OFFICE OF STANDARDS SERVICES

**COMMERCIAL STANDARD CS227-59**  
**POLYETHYLENE FILM**

Commercial Standard CS227-59, Polyethylene Film, was withdrawn by the U.S. Department of Commerce.

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The following was used to replace CS227: National Flexible Packaging Association Specification B-11, Low Density Polyethylene Film for General Use and Packaging Applications.

**To obtain copies and/or guidance and assistance for additional information and other sources, contact**

**Flexible Packaging Association (FPA)**  
(formerly National Flexible Packaging Association-NFPA)  
1090 Vermont Avenue, NW, Suite 500  
Washington, D.C. 20005, USA  
Telephone: (202) 842-3880  
Fax: (202) 842-3841

**Society of the Plastics Industry (SPI)**  
1275 K Street, NW, Suite 400  
Washington, D.C. 20005, USA  
Telephone: (202) 371-5200  
Fax: (202) 371-1022

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The following two standards may be useful: ANSI/ASTM D2103, Standard Specification for Polyethylene Film and Sheeting; and ASTM D5047, Standard Specification for Polyethylene Terephthalate Film and Sheeting.

**For guidance and assistance on additional standards, sources for ASTM technical committee/subcommittee (example: D20.19 Film and Sheeting) and to obtain copies, contact:**

Committee D20 on Plastics  
**American Society for Testing and Materials (ASTM)**  
100 Barr Harr Drive  
West Conshohocken, Pennsylvania 19428-2959, USA  
Telephone: (610) 832- 832-9721; Fax: (610) 832-9666  
General Inquiries/Orders: (610) 832-9500/-9585  
Fax: (610) 832-9555; Internet: <http://www.astm.org>  
E-mail addresses: Customer Service - [service@astm.org](mailto:service@astm.org)  
Information Center - [infoctr@astm.org](mailto:infoctr@astm.org)

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COMMERCIAL STANDARD **CS227-59**

Reprinted 1964 with Amendments

**WITHDRAWN**

# Polyethylene Film

A recorded  
voluntary standard of the  
trade published by  
the U.S. Department  
of Commerce



For sale by the Superintendent of Documents

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**WITHDRAWN**

# **U.S. DEPARTMENT OF COMMERCE**

## **NATIONAL BUREAU OF STANDARDS**

### **Office of Commodity Standards**

#### **EFFECTIVE DATE**

Having been passed through the regular procedures of the Office of Commodity Standards (formerly the Commodity Standards Division, Office of Technical Services; transferred to the National Bureau of Standards July 1, 1963) and approved by the acceptors hereinafter listed, this Commercial Standard is issued by the U.S. Department of Commerce, effective November 15, 1959.

LUTHER H. HODGES, *Secretary*.

#### **COMMERCIAL STANDARDS**

Commercial Standards are developed by manufacturers, distributors, and users in cooperation with the Office of Commodity Standards of the National Bureau of Standards. Their purpose is to establish quality criteria, standard methods of test, rating, certification, and labeling of manufactured commodities, and to provide uniform bases for fair competition.

The adoption and use of a Commercial Standard is voluntary. However, when reference to a Commercial Standard is made in contracts, labels, invoices, or advertising literature, the provisions of the standard are enforceable through usual legal channels as a part of the sales contract.

Commercial Standards originate with the proponent industry. The sponsors may be manufacturers, distributors, or users of the specific product. One of these three elements of industry submits to the Office of Commodity Standards the necessary data to be used as the basis for developing a standard of practice. The office by means of assembled conferences or letter referenda, or both, assists the sponsor group in arriving at a tentative standard of practice and thereafter refers it to the other elements of the same industry for approval or for constructive criticism that will be helpful in making any necessary adjustments. The regular procedure of the office assures continuous servicing of each Commercial Standard through review and revision whenever, in the opinion of the industry, changing conditions warrant such action.

#### **SIMPLIFIED PRACTICE RECOMMENDATIONS**

Under a similar procedure the Office of Commodity Standards cooperates with industries in the establishment of Simplified Practice Recommendations. Their purpose is to eliminate avoidable waste through the establishment of standards of practice for sizes, dimensions, varieties or other characteristics of specific products; to simplify packaging practices; and to establish simplified methods of performing specific tasks.

# Polyethylene Film

[Reprinted 1964 With Amendment No. 1, Effective\* June 1, 1963]

## 1. PURPOSE

1.1 The purpose of this Commercial Standard is to establish a national standard for the information and guidance of producers, distributors, and consumers; to promote understanding between buyers and sellers; to provide a basis for fair competition among producers; to give the consumer confidence in the quality of these products; and to provide a means of identifying products conforming to this standard.

## 2. SCOPE

2.1 This standard covers dimensional tolerances, types, grades, classes, and kinds of polyethylene film, intrinsic quality requirements, and test methods. The dimensional tolerances include thickness, yield, width, length, and flatness. The intrinsic quality requirements include density, appearance, impact properties, tensile properties, slip, clarity, ink adhesion, heat sealability, and odor. A sampling method is included.

## 3. TERMINOLOGY AND GENERAL DESCRIPTION OF PRODUCTS COVERED

3.1 The plastics terminology used in this Commercial Standard is in accordance with the definitions given in ASTM D883-58T, Tentative Definitions of Terms Relating to Plastics, unless otherwise indicated.

3.2 **General Description.**—This standard covers flexible (nonrigid) unsupported flat or tubular polyethylene film, 0.001 to 0.004 inch inclusive in thickness, and up to 60 inches in width having a density of 0.914 to 0.929 g/cm<sup>3</sup> and intended for general use or packaging. The film shall be natural color (essentially colorless) unless a color has been agreed upon by supplier and purchaser. Polyethylene resins meeting the requirements of ASTM D1248-58T, Specifications for Polyethylene Molding and Extrusion Materials, Type I, Class A, and Grades 2, 3, and 4, have been found suitable for making films meeting the requirements of this Commercial Standard.

## 4. TYPES, GRADES, CLASSES, AND FINISHES

4.1 Polyethylene film is available in various thicknesses and widths in the following types, grades, classes, and finishes in accordance with the requirements of this Commercial Standard:

### *Types.*

- Type I. General purpose
- Type II. Impact resistant

### *Grades.<sup>1</sup>*

- Grade 1. Low slip
- Grade 2. Medium slip
- Grade 3. High slip

<sup>1</sup> These grades are available with and without slip additives. Purchasers should indicate whether or not slip additives are desired. Grade 1 normally contains no slip additive; Grades 2 and 3 normally contain slip additives.

\*Effective date of original issue, November 16, 1959.

**Classes.**

Class 1. Normal clarity

Class 2. High clarity

**Finish.**

Finish 1. Untreated for ink adhesion

Finish 2. Treated for ink adhesion

## 5. DIMENSIONAL REQUIREMENTS

**5.1 Thickness Tolerances.**—The allowable point to point tolerances for various thicknesses shall be as follows, when measured in accordance with 7.3:

Width <sup>1</sup>	Nominal thickness	Tolerance
<i>inch</i> 36 and less	<i>inch</i> 0.0010 up to but not including 0.0015	<i>percent</i> ± 25
over 36 to 60, inclusive	0.0015 through 0.0040	± 20
	0.0015 up to but not including 0.0020	± 25
	0.0020 through 0.0040	± 20

<sup>1</sup> The dimension across a single thickness of sheeting or a double thickness of flattened tubing.

**5.2 Yield Tolerances.**—The actual yield when determined in accordance with 7.4 shall be within the following tolerance limits of the nominal value:

Any one roll .....	± 10 percent
Lots up to 500 lb, inclusive .....	± 10 percent
Lots over 500 lb to 2500 lb .....	± 5 percent
Over 2500 lb .....	± 3 percent

**5.3 Width Tolerances.**—The tolerances for width shall be within the following limits:

Width	Tolerance
<i>inch</i> 12 or less	<i>inch</i> ± $\frac{1}{8}$
over 12 to 30, inclusive	± $\frac{3}{16}$
over 30 to 50, inclusive	± $\frac{3}{8}$
over 50 to 60, inclusive	± $\frac{1}{2}$

**5.4 Length.**—The length of film per roll shall be as agreed upon by the manufacturer (or vendor) and the purchaser. Each roll shall be in one piece, except that not more than 20 percent of the rolls in any one shipment may consist of not more than three pieces. Such rolls shall be clearly marked.

**5.5 Flatness.**—The variations in length of cut strips as a measurement of flatness shall not exceed the limits, as shown in table 1, when tested in accordance with 7.5.

TABLE 1.—Flatness variations

Width	Variation
<i>inch</i>	<i>percent</i>
12 or less	±0.4
over 12 but not including 36	±0.7
36 to 60	±1.0

## 6. INTRINSIC QUALITY REQUIREMENTS

6.1 **Density.**—The density shall be between 0.914 and 0.929 g/cm<sup>3</sup> when determined in accordance with 7.6.

6.2 **Appearance.**—The material shall have appearance qualities conforming with those produced by good commercial practice. It shall be as free as is commercially possible of gels, streaks, pinholes, particles of foreign matter, or undispersed raw material. There shall be no other visible defects, such as holes, tears, or blisters. The edges shall be free of nicks and cuts visible to the unaided eye. There shall be no visible evidence of damage from shipping.

6.3 **Impact Resistance.**—Determinations of impact resistance shall be made in accordance with the test method specified in 7.7. The value obtained shall be in accordance with the value given in table 2. Values for thicknesses other than those listed in table 2 shall be determined by interpolation arithmetically or from the graph shown in figure 6.3.1.

TABLE 2.—Impact resistance

Type I—General purpose, min	
Film thickness	Dart test
<i>mil</i>	<i>g</i>
1.0	40
1.5	65
2.0	85
3.0	125
4.0	165
Type II—Impact resistant, min	
1.0	75
1.5	105
2.0	135
3.0	195
4.0	255

6.4 **Tensile Properties.**—The average tensile strength and elongation at break for all thicknesses when tested in accordance with 7.8 shall be in accordance with table 3.

TABLE 3.—Tensile strength

	Direction	
	Lengthwise	Crosswise
Tensile strength, min, psi.....	1700	1200
Elongation, min, percent.....	225	350

6.5 **Slip.**—The kinetic coefficient of friction for polyethylene film when tested in accordance with 7.9 shall be as follows:

- Grade 1. Low slip: Not greater than 0.8.  
 Grade 2. Medium slip: Not greater than 0.5.  
 Grade 3. High slip: Not greater than 0.2.

6.6 **Clarity.**—The 45° gloss, haze, and see-through of polyethylene film when determined in accordance with 7.10 shall be as follows:

	45° Gloss	Haze	See-through
Class 1. Normal clarity.....	min 30	max 25%	min 2 ft
Class 2. High clarity.....	min 45	max 11%	min 20 ft

These three measurements do not always correlate. The particular measurement concerned with the application shall govern in case of an inconsistency.

6.7 **Ink Adhesion.**—The ink pickoff when determined in accordance with 7.11 shall be as follows:

- Finish 1. Untreated for ink adhesion. No requirement  
 Finish 2. Treated for ink adhesion. Less than 10 percent pickoff

6.8 **Heat Sealability.**—The minimum coefficient of heat seal strength in the two principal directions when the film is sealed and tested in accordance with 7.12 shall be as follows:

Treated to treated.....	0.60 minimum
Untreated to treated.....	0.60 minimum
Untreated to untreated.....	0.75 minimum

6.9 **Odor.**—The polyethylene film shall be rated "satisfactory" when tested in accordance with 7.13. The selection of an odor standard and the number of panel members conducting the test shall be agreed upon by the interested parties.

## 7. TEST METHODS

7.1 **Conditioning.**—The test specimens shall be conditioned in accordance with Procedure A in ASTM D618-58, Standard Method of Conditioning Plastics and Electrical Insulating Materials for Testing, and shall be tested under these conditions, unless otherwise specified.

7.2 **Sampling.**—Samples for test shall be taken from rolls selected

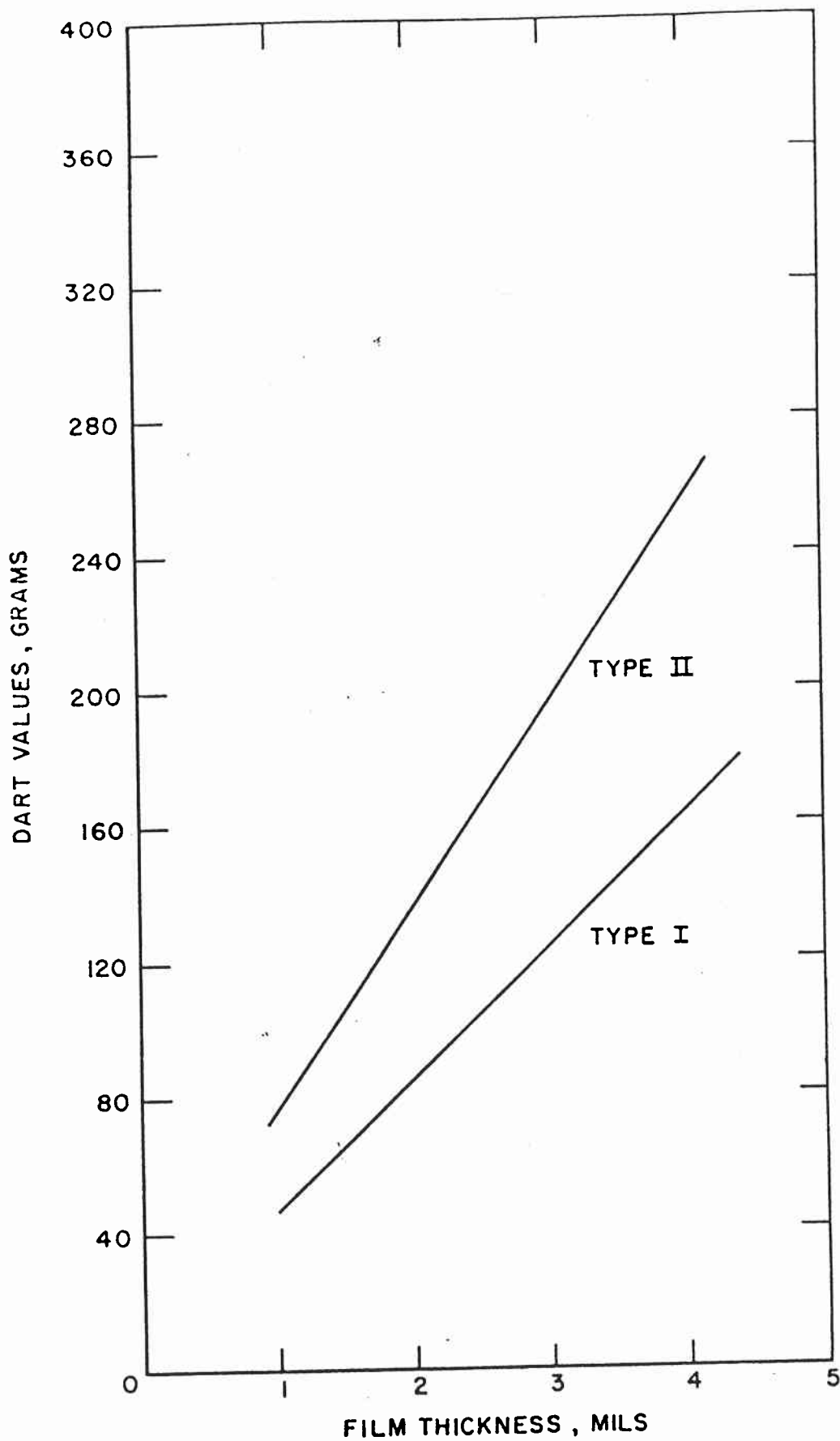


FIGURE 6.3.1. Impact resistance requirements for dart test on polyethylene film.

at random from the total number of rolls in each shipment or lot as follows:

Rolls in shipment or lot	Rolls sampled
2-15	2
16-40	3
41-65	5
66-110	7
111-180	10
181-300	15
301-500	25
501-800	35
801-1300	50

The sample for test shall be full width and shall be cut from an undamaged part of the film on each roll and at least 3 full turns but not less than 5 linear feet from either end of the film on the roll. Normally about 100 square feet of film is needed to make all the tests and the length shall be at least 9 feet.

The specimens for particular tests shall be cut from different parts of the film sample (that is, they shall not be cut adjacent to one another), unless otherwise specified in the method of test.

**7.3 Thickness.**—The thickness shall ordinarily be determined by the method described in 7.3.1. Where high accuracy is required, or for arbitration purposes, the method described in 7.3.2. shall be used. The apparatus used in both tests shall be installed and operated according to the procedure recommended by the manufacturer of the apparatus.<sup>2</sup> When gages are used that apply a load to the film, the readings shall be taken between 2 seconds and 2 minutes after the load is applied, and the load shall not create a stress in the film greater than 10 psi. The apparatus shall be checked periodically with gage standards. The thicknesses of gage standards shall be known to  $\pm 0.00001$  inch and be calibrated by the National Bureau of Standards, Washington, D.C., 20234, Pratt and Whitney Co., West Hartford, Conn., or other organizations offering comparable service.

**7.3.1 General Method.**—This method is capable of producing measurements with a maximum error of  $\pm 0.0001$  inch.

**7.3.1.1 Apparatus.**—A deadweight dial micrometer with a flat anvil of  $\frac{1}{4}$ -inch diameter or larger in area and a  $\frac{3}{16}$ -inch diameter flat surface on the head of the spindle. Unless otherwise specified herein, the micrometer shall meet the requirements of the apparatus in Method C of ASTM D374-57T, Tentative Method of Test for Thickness of Solid Electrical Insulation.

**7.3.1.2 Specimens.**—Five specimens, at least 2 by 2 inches in area, taken uniformly across the width of the roll shall be tested. At least one set of specimens shall be measured from each roll being tested.

<sup>2</sup> Types of thickness measuring gages are described in National Bureau of Standards Circular 585, issued January 20, 1958: Names of manufacturers are also given. This publication is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402 for 50 cents.

7.3.1.3 **Procedure.**—Unless otherwise specified, the procedure shall be in accordance with that in Method C of ASTM D374-57T. The surfaces of the anvil and spindlehead, and of the specimen, shall be clean and dry. Place the specimen on the anvil and lower the spindlehead onto it slowly. The total load applied by the spindle shall be 4 ounces. One measurement shall be made on each specimen. The measurements of all the specimens of a sample shall be averaged to obtain the thickness of the sample.

7.3.2 **Arbitration method.**—This method is capable of producing measurements with a maximum error of  $\pm 0.00005$  inch.

7.3.2.1 **Apparatus.**—Any type of apparatus capable of measuring thickness in the range covered by this standard to an accuracy of better than  $\pm 0.00005$  inch and which has been calibrated for use with polyethylene film.

7.3.2.2 **Specimens.**—Five specimens, at least 2 by 2 inches, taken uniformly across the width of the roll shall be tested. At least one set of specimens shall be measured from each roll being tested.

7.3.2.3 **Procedure.**—The procedure recommended by the manufacturer of the gage shall be followed. The gage parts contacting the film and the film specimen shall be clean and dry. One measurement shall be made on each specimen. The measurements from all the specimens of a sample shall be averaged to obtain the thickness of the sample.

7.4 **Yield.**—Yield is the amount of area provided by a given weight of a film of specified thickness. The actual yield shall be calculated as follows:

$$Ya = \frac{A}{W}$$

Where  $Ya$  = actual yield, in square inches per pound

$W$  = weight, in pounds

$A$  = area, in square inches.

The area shall be calculated from the length and width of the film on the roll. The weight shall be the weight of the film on the roll.

The nominal yield shall be calculated as follows:

$$Yn = \frac{27.68}{dt}$$

Where  $Yn$  = nominal yield, in square inches per pound

$d$  = density, in  $g/cm^3$

$t$  = thickness, in inches.

The thickness and density values shall be determined in accordance with 7.3 and 7.6, respectively.

The deviation of the actual yield from the nominal yield shall be calculated as follows:

$$D = \frac{100(Yn - Ya)}{Yn}$$

Where  $D$  is the deviation from the nominal yield in percent.

7.5 **Flatness.**—Flatness shall be determined in accordance with

ASTM D1604-58T Measurement of Flatness of Plastic Sheet or Tubing.

**7.6 Density.**—The density shall be determined on the sample as received in accordance with ASTM D1505-57T, Tentative Method of Test for Measurement of Density of Plastics by the Density-Gradient Technique.

**7.7 Impact Resistance.**—The impact resistance shall be determined by the following procedure:

**7.7.1 Dart Impact.**

**7.7.1.1 Definition of Impact Failure Load.**—That load at which 50 percent of the specimens fail when tested by this method.

**7.7.1.2 Apparatus.**—The apparatus shall consist of the components specified in the following paragraphs (a) to (j) and be constructed essentially as shown in figure 7.7.1.2.

(a) Specimen Clamp.—A two-piece annular specimen clamp having an inside diameter of 5 inches and conforming to the following requirements:

(1) The lower or stationary half of the clamp shall be rigidly mounted so that the plane of the specimen is horizontal and at an angle of 90° with respect to the upright, dart-supporting member of the apparatus.

(2) The upper or movable portion of the clamp shall be designed to maintain positive and planar contact with the lower portion of the clamp when in position. This portion of the clamp shall be provided with suitable means for maintaining sufficient contact with the lower clamp to hold the film specimen firmly in place during the test.<sup>3</sup>

(3) Gasketing materials prepared from rubber or similar materials shall be affixed to the specimen contact surfaces of both clamps.<sup>4</sup> This provides a cushion which minimizes thickness variation effects. It allows firm gripping of the specimen and minimizes slippage.<sup>5</sup>

(b) Electromagnet, capable of supporting a 1 kg weight, for use in supporting and releasing the dart assembly. It shall be equipped with a centering device to insure reproducible drop and a suitable interrupted source of electric power to energize and de-energize the electromagnet.

(c) Dart, consisting of a 1½-inch diameter hemispherical head fitted with ¼-inch diameter shaft 4½ inches long, to accommodate removable weights. The head shall be constructed of aluminum, phenolic plastic, or other low-density material of similar hardness. The shaft shall be attached to the center of the flat upper surface of the head with its longitudinal axis at 90° to the surface. The shaft shall be made of aluminum with a ½-inch long steel tip at the end to which the electromagnet is attached.

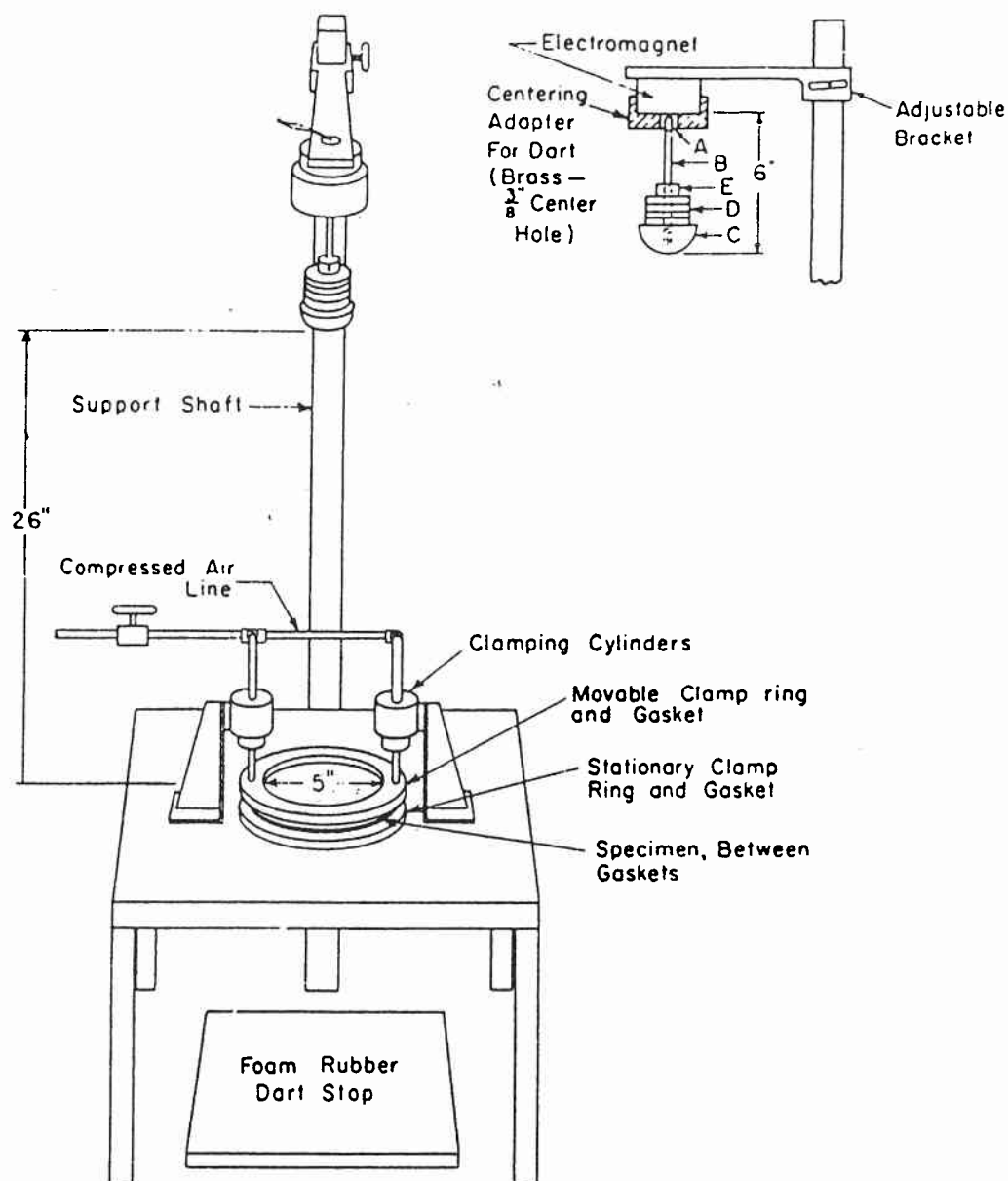
(d) Weights.—Stainless steel detachable weights are required as follows:

(1) Twenty-four weights of  $15.0 \pm 0.1$  g each, having approximate dimensions of 1.250 inches in diameter, with a hole in the center 0.02505 inch in diameter and 0.1008 inch in thickness.

<sup>3</sup> Pneumatically operated upper clamps have been successfully employed.

<sup>4</sup> Rubber gasketing ⅜ inch thick, 50 to 60 Shore A Durometer hardness, 5 inches ID, and 6 inches OD has been found satisfactory for this purpose.

<sup>5</sup> Slippage during the test may be determined by inserting straight pins into the clamped specimen periphery in contact with the outside wall of the clamps. Elongation of the holes after test indicates slippage. Applied pressure of 90 psi has been found sufficient to minimize slippage.



**Legend, Dart Assembly:**

- A. Steel shaft tip  $\frac{1}{4}$  in. OD by  $\frac{1}{2}$  in. long.
- B. Dart shaft—aluminum  $\frac{1}{4}$  in. OD by 5 in. long;  $\frac{1}{4}$ —20 thd. (N.C.)  $\frac{1}{2}$  in. long on bottom; No. 5—40 thd. (N.F.) for steel tip.
- C. Semi-spherical head  $1\frac{1}{2}$  in. in diameter.
- D. Removable weights.
- E. Collar and set screw.

FIGURE 7.7.1.2.—Apparatus for free falling dart-impact test.

(2) Five weights of  $5.0 \pm 0.1$  g each, similar in construction to those specified in 7.7.2.2(d)(1), except that the thickness shall be altered to obtain this specified weight.

(e) Positioning Device.—Means shall be provided for positioning the dart at a drop height of 26.0 inches from the impinging surface of the dart head to the surface of the test specimen.

(f) Micrometer, accurate to  $\pm 0.0001$  inch in the range of 0.0001 to 0.0100 inch, for measuring specimen thickness.

(g) Cushioning and shielding devices, to protect personnel and to avoid damaging the impinging surface of the dart.

**7.7.1.3 Test Specimens.**—Test specimens shall be large enough to extend outside the specimen clamp gaskets at all points. The specimens shall be representative of the material under study and shall be free of pinholes, wrinkles, folds, or other obvious imperfections, unless such imperfections constitute variables under study.

**7.7.1.4 Procedure.**—(a) Measure and record the average thickness of each specimen to the nearest 0.0001 inch based on a minimum of four measurements per specimen, representative of the area being tested.

(b) Place the specimen over the bottom portion of the clamp, making certain that it is uniformly flat, free of folds, and that it covers the gasket at all points. Clamp the specimen in place by applying annular pressure with the top portion of the clamp.

(c) Energize the electromagnet and position the dart vertically with the steel shaft tip inserted in the magnet adapter and the impinging surface of the dart 26 inches from the film surface.

(d) De-energize the electromagnet, thereby releasing the dart. Care shall be taken to avoid multiple impact in cases where the dart bounces off the specimen. The operator should attempt to catch the dart in such cases to prevent damage to the impinging surface.

(e) Examine the specimen to determine whether or not it has failed. Failure is defined as any break through the film. Such a break can be observed readily by viewing the specimen under back lighting conditions.

(f) Use a new specimen for each impact.

(g) In establishing the failure load of a material, it is recommended that the test be started at a load at which 50 percent failure is expected. Test a minimum of ten specimens at this load and record the number of failures. In the event that all of the specimens fail or do not fail, decrease or increase the load, respectively, by 15 g and repeat the test. When necessary, repeat this procedure until both failures and nonfailures occur, in a particular group of ten specimens. At this point, change the load by uniform increments of 5, 10, or 15 g and test a minimum of ten specimens at each load until both the no-failure and all-failure loads are included. The load increment should be selected to give a minimum of four points between the 0 and 100 percent failure loads.

**7.7.1.5 Calculation.**—Calculate the percent of failures from the specimens tested at each load. The impact failure load shall be calculated by the following formula:

$$L_F = L_L - L \left( \frac{S}{100} - \frac{1}{2} \right)$$

where:

$L_F$  = impact failure load, in grams,

$L_L$  = lowest load, according to particular increment being used, at which failure of all the specimens occurs (ten specimens),

$L$  = load increment, in grams, and

$S$ =sum of the percentage of breaks at each load (from the maximum load corresponding to no breaks up to and including the lowest load,  $\bar{L}_L$ )

**7.8 Tensile Properties.**—The tensile properties of polyethylene film shall be determined in accordance with Method A in ASTM D882-56T, Tentative Methods of Test for Tensile Properties of Thin Plastics Sheets and Films. The thickness of the specimens shall be measured in accordance with 7.3.

**7.9 Slip.**

**7.9.1 Scope.**—The coefficient of friction is the ratio of the frictional resistance to the normal pressure acting on two surfaces in contact. This coefficient of friction is an inverse measure of the relative ease with which the surface of one material will slide over a similar surface or over the surface of another material.

**7.9.2 Apparatus.**—The inclined plane apparatus shall consist of the following:

(a) A smooth board approximately 26 by 26 by  $\frac{3}{4}$  inches to serve as the plane.

(b) A steel block  $2\frac{1}{2}$  by 4 by  $\frac{3}{4}$  inches to serve both as a carrier and a loading medium for the sliding specimen.

(c) A piece of 12 by  $2\frac{3}{4}$  by  $\frac{1}{8}$  inches thick cellular rubber sheeting of medium density as a cover for the block to assure intimate contact between the sliding and the stationary specimens. The rubber is brought up and around the ends of the block (sled) to fit snugly and is taped in place. The total weight of block and rubber shall be 1000 grams.

(d) An interval timer.

(e) A vertical coefficient of friction indicator (tangent scale) graduated in 0.02 tangent units.

(f) Four strips of cellophane tape 20 inches in length and 1 inch wide shall be taped approximately 4 inches apart to the top surface of the plane so that the long dimension is parallel to the sliding motion of the block. These strips are marked at intervals of 2.5 inches with a wax crayon to serve as the scale for the sliding block.

**7.9.3 Specimens.**—Extreme care shall be taken in handling the material to keep the surface free of dust, lint, or fingerprints. Specimens for the plane shall be 22 inches in the machine direction and 17 inches in the transverse direction. The specimens for the sponge-rubber covered metal sled shall be 12 inches in the machine direction and 3 inches in the transverse direction. Both specimens shall be cut from contiguous areas of the same piece. Sufficient block and plane specimens of each sample shall be cut so that tests of side A to side A, side A to side B, and side B to side B can be made.

**7.9.4 Procedure.**—Level the apparatus. Tape the larger specimen to the clean dry surface of the plane over the crayon-marked cellophane tape, smoothing the film sufficiently to eliminate wrinkles without stretching it. Tape the smaller specimen to the sponge-rubber covered metal block with the machine direction of the film parallel to the length of the block, pulling tightly to eliminate wrinkles without stretching the film. All combinations of the two sides, A and B, of the film shall be tested.

With the plane at an angle of zero degree place the film-covered block on the film specimen, (a) on the plane so that the long dimension is parallel to the inclination when the plane is tilted, (b) with the two polyethylene film surfaces in contact, and (c) near the end of the plane that will be elevated.

Slowly elevate the plane until that angle is reached which is just sufficient to allow the block to slide of its own accord. Stop elevating the plane at this point. If the film-covered block stops sliding before it has traveled 12.5 inches, change the film on the block and place it on a fresh portion of the film on the plane. Then elevate the plane in increments of 0.02 tangent units on the vertical coefficient of friction indicator, until the block travels, unaided, at least 12.5 inches. The tangent of the angle at which the block slides this distance is recorded as the static coefficient of friction of the specimen being tested. This tangent is read directly from the vertical coefficient of friction indicator, the top side of the plane being the reference point. Do not test a block specimen more than once and do not use the same portion of the specimen on the plane more than once for test purposes.

Raise the plane to a position 0.02 to 0.04 tangent units higher than the static coefficient of friction. Mount a new film specimen on the metal block and place the block on the plane for test as described above. Hold the block in place for at least 10 seconds and then release. If the block does not begin to slide of its own accord, nudge it slightly to initiate sliding. When the block begins to slide, start the timer and determine the time it takes for the block to slide 2.5, 5.0, 7.5, 10.0, and 12.5 inches. The rate of sliding shall be approximately constant over the 12.5-inch length. Only the time for the last 10 inches is used to calculate the coefficient of friction. If any marked acceleration or deceleration is noted, discard the determination and repeat the test. Calculate the reciprocal rate of sliding as follows:

$$\frac{\text{Time to slide 12.5 in} - \text{time to slide 2.5 in}}{10} = \text{rate in s/in}$$

This gives the rate at which the block slides down the plane 10 inches. Repeat this procedure at various angles using fresh specimens each time until at least two reciprocal rates above and two below 30 s/in are obtained. The kinetic coefficient of friction is calculated at a reciprocal rate of sliding of 30 s/in. The rates of sliding above and below 30 s/in. are plotted with rates of sliding versus the corresponding tangents. The tangent corresponding to a reciprocal rate of 30 s/in. is taken from this plot. This tangent is numerically equal to the kinetic coefficient of friction of the sample. If a reciprocal rate of sliding slower than 30 s/in. cannot be obtained then the kinetic coefficient of friction is taken as the tangent of the lowest angle at which the block will slide at least 12.5 inches.

**7.10 Clarity.**—The clarity of polyethylene film shall be determined by the following methods of test: 45° gloss; haze; and see-through.

**7.10.1 Specimens.**—The specimens for 45° gloss and haze shall be cut in accordance with the applicable methods of test listed in 7.10.2 and 7.10.3. The test specimens for 7.10.4 see-through shall be squares big enough to have an unsupported area at least 3 by 3 inches when

mounted in a convenient, portable support. Three specimens shall be used for each test procedure.

**7.10.2 Gloss.**—Gloss shall be determined in accordance with ASTM C346-59, Standard Method of Test for 45 Specular Gloss of Ceramic Material. The polyethylene film specimen shall be mounted in a wrinkle-free, but relatively unstretched condition, on some device such as embroidery hoops or by taping onto a rigid tilelike support. In either case, for the measurement, the film shall be backed up by a nonreflecting black surface. This latter can be accomplished by using either a darkened space, black paper, or coating a tile support with dull blackboard slating.

**7.10.3 Haze.**—Haze shall be determined in accordance with ASTM D1003-52, Standard Method of Test for Haze and Luminous Transmittance of Transparent Plastics.

**7.10.4 See-through.**—See-through defines how clearly the detail of an object not in contact with the film, can be observed through the film.

**7.10.4.1 Apparatus.**—

- (a) Chart as shown in figure 7.10.1.
- (b) Fluorescent illuminator as shown in figure 7.10.2.
- (c) Blinkers as shown in figure 7.10.3. The blinkers cover one eye and restrict oblique illumination from entering the other.
- (d) Hall or room relatively free from oblique illumination.
- (e) Means to measure the distance from the specimen to the chart in feet, which is facilitated by marking one-foot distances on the floor, starting at the chart.

**7.10.4.2 Procedure.**—Set up the chart at the observer's eye level and illuminate as shown in figure 7.10.2. Place the blinkers over observer's eyes. Hold the specimen essentially parallel to and in front of blinkers as indicated in figure 7.10.2. Have observer move toward or away from the chart until the vertical and horizontal bars change from clearly defined lines to less distinct images. Record nearest distance in feet to chart at which this occurs. Rotate the specimen and retest. When readings are within 2 feet of one another average the readings to the nearest foot. When the readings differ by more than 2 feet use smaller distance.

**7.11 Ink Adhesion.**

**7.11.1 Apparatus.**—The apparatus shall consist of the following:

- (a) A clean flat table at least 6 feet long and 2 feet wide.
- (b) A roll of No. 44 Texcel tape,  $\frac{1}{2}$  inch wide, or equivalent.
- (c) One roll of commercial pressure-sensitive adhesive cellophane tape, 1 inch wide.
- (d) Scissors.
- (e) A smooth rubber roller and metal clip, as used in photography
- (f) Flexible cord, approximately 6 feet long with a diameter of  $\frac{1}{32}$  inch.
- (g) A sandbag weighing 1500 grams.
- (h) Two steel bars, approximately  $\frac{1}{4}$ -inch thick, 2 inches wide, and 15 inches long.
- (i) A timer, accurate to  $\pm 1$  second.
- (j) A spatula with a blade 4 inches long and  $\frac{1}{2}$  inch wide.

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Footnote 6 deleted by amendment No. 1.

**F A P E O T F D Z E A Z T**

FIGURE 7.10.1.—Chart for see-through test.

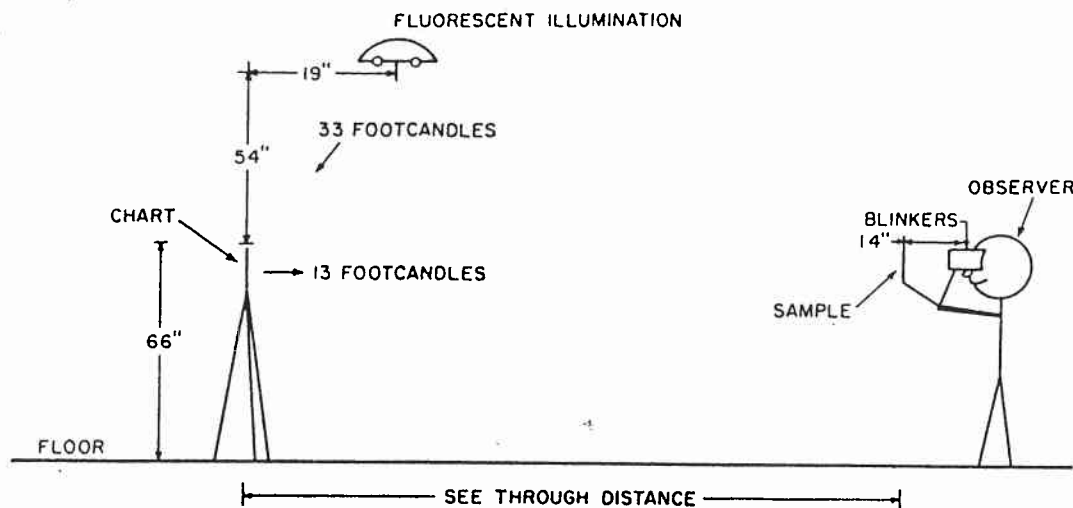


FIGURE 7.10.2.—Schematic for visual determination of see-through.

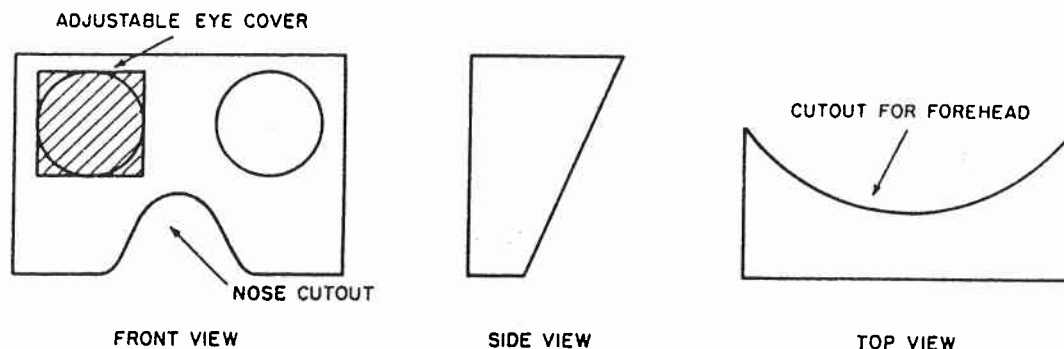


FIGURE 7.10.3.—Blinkers for visual determination of see-through.

- (k) A circulating air oven capable of maintaining a temperature of  $40^{\circ} \pm 3^{\circ} \text{C}$  ( $105^{\circ} \pm 5^{\circ} \text{F}$ ).
- (l) A Cenco-Bakelite Pulley No. 75660, or equivalent.<sup>7</sup>
- (m) An Anilox Hand Proofer, 165 line screen, or equivalent.<sup>8</sup>
- (n) No. 3 Zahn Cup Viscometer, or equivalent.<sup>9</sup>
- (o) SPI Standard Ink Sample Flexo Ink No. 1, or equivalent.<sup>10</sup>
- (p) Denatured ethyl alcohol, 95 percent.

7.11.2 **Specimens.**—The specimens shall be 6 inches by the width of the material. Three specimens shall be tested.

7.11.3 **Procedure.**—Select printing side of film specimen and place if face up on the table, taking care that this side is not handled, smudged, or wiped. Anchor one 6-inch end of the film by a clip or weight to prevent slippage during ink application. Stir ink thoroughly, adjust viscosity with alcohol to 22 seconds using the No. 3 Zahn cup. Apply approximately 5 ml of diluted ink to nip of Anilox hand proofer and roll ink out over the entire length of the specimen. When specimen is unusually long, it may be necessary to make several

<sup>7</sup> Available from Central Scientific Co., 1702 Irving Park Rd., Chicago, Ill.

<sup>8</sup> Available from Interchemical Corp., P.O. Box 35, Hackensack, N.J.

<sup>9</sup> Available from General Electric Co., Schenectady, N.Y.

<sup>10</sup> Available from The Society of the Plastics Industry, Inc., 250 Park Avenue New York, N.Y., 10017.

such rollouts. Allow ink to dry in air for 5 minutes, place in circulating air oven at  $40^{\circ} \pm 3^{\circ}\text{C}$  ( $105^{\circ} \pm 5^{\circ}\text{F}$ ) for 10 minutes to insure removal of solvent. Remove inked specimen from oven, allow to cool for 1 minute and place on testing table, printed side down. Apply a piece of 1-inch wide pressure-sensitive adhesive cellophane tape down the center of the entire length of the uninked side to prevent specimen from tearing during the test. Roll out any air bubbles or wrinkles with a soft roller. Turn specimen over so that inked side is up.

Place the two steel bars on either side of the inked area to prevent motion of the specimen during the cellophane tape test. Apply a piece of the  $\frac{1}{2}$ -inch wide No. 44 Texcel tape or equivalent over the inked area of the specimen, the uninked side of which is supported by the strip of the 1-inch wide pressure sensitive adhesive cellophane tape. The  $\frac{1}{2}$ -inch wide tape shall be 3 inches longer than the specimen and the free 3-inch end of the tape shall be turned back, on itself by  $180^{\circ}$  to form a tab. Roll out any air bubbles or wrinkles under the No. 44 Texcel tape with the soft rubber roller. Attach clip fastened to cord, which supports the 1500 gram sand bag, to the tab of the  $\frac{1}{2}$ -inch tape. Place cord over the pulley and allow slack to be taken up and then release the sand bag.

Examine the inked area of the film which was under the tape to determine degree of ink removal. Estimate the percent of area from which ink is removed using successive areas 3 inches long by  $\frac{1}{2}$  inch wide (the width of the tape) for this purpose. The total stripped area of the specimen shall be examined and the estimates made on the small areas averaged. The results from the three specimens shall be averaged.

**7.12 Heat Sealability.**—The heat sealability is expressed as a coefficient of heat sealability which is the ratio of the tensile strength of the heat sealed film specimens to that of the original film specimens of a sample. The test results when properly interpreted provide information concerning the strength of seals that may be obtained under the sealing conditions described in this method.

**7.12.1 Apparatus.**—(a) **Sealer.**—The sealer shall consist of a resilient lower platen and a heated movable upper platen between which the film can be sealed.<sup>11</sup> The temperature over the entire surface of the heated surface of the heated platen shall be controlled to within  $\pm 5$  percent.<sup>12</sup> The pressure applied by the upper platen to the lower platen shall be uniform over the contacting area and shall be applied by means of air cylinders. The dwell time shall be controlled to  $\pm 0.02$  second by an electric timer. The movable upper platen shall not have sharp edges but shall be rounded to a radius of approximately  $\frac{1}{32}$  inch. The heated platen shall be capable of being maintained at the sealing temperature of  $177^{\circ} \pm 3^{\circ}\text{C}$  ( $350^{\circ} \pm 5^{\circ}\text{F}$ ) in the region where the seal is made.

(b) **Slip sheets.**—No. 300 PT cellophane.

(c) **Cutter.**—The specimens shall be cut to the proper width with paper cutters, trimmers, hand striking dies, or other suitable devices that will give straight, clean, parallel edges with no nicks,

<sup>11</sup> Sentinel Theater Model 12A meets the requirements of this method and is manufactured by Packaging Industries, Ltd., 151 Pine St., Montclair, N.J.

<sup>12</sup> Calibrate the indicating thermometer by means of a pyrometer contacting the upper heated bar sealing surface. Use a variable rheostat to control the operating temperature.

uncut areas, or other imperfections. It is imperative that the cutting edges be kept sharp and free from scratches and nicks.

**7.12.2 Specimens.**—The test specimens shall consist of strips of uniform width and thickness, at least 5 inches long and 1 inch wide. The utmost care shall be exercised in cutting strip specimens to prevent nicks and tears in the edges which might give rise to premature fractures. The edges shall be parallel to within 2 percent of the width over the length of the specimen between the grips.

Twenty test specimens shall be cut contiguous to one another from the sample of film. Ten shall be cut with their long axes parallel to the lengthwise or machine direction of the film and ten shall be cut with their long axes 90° to the lengthwise direction. Five specimens from each set of 10 shall be used to obtain the tensile strength of the original film. These are identified as the control specimens. Five specimens from each set of 10 shall be individually marked at each end and each one cut into two pieces crosswise at the midsection so that the same cut ends from each test specimen can be sealed together again. These are identified as the sealed specimens.

**7.12.3 Procedure.**—The tensile strength of the control specimens shall be measured in accordance with 7.8 using an initial distance between the grips of 2 inches. The results obtained with the 5 specimens in each direction shall be averaged, thus giving two average results.

The two cut halves of each specimen shall be sealed together in such a manner that an acceptable tensile test specimen is obtained. The seals shall be made at a pressure of  $30 \pm 1$  psi and at a dwell time of  $0.5 \pm 0.2$  seconds. The width of the seal shall be  $0.50 \pm 0.02$  inch. The length of the seal shall be equal to the width of the specimen and at 90° to the long axis of the specimen. The overlapping of the two halves of the specimen shall be less than 0.75 inch. The halves of the five cut specimens shall be sealed at 350 °F for each orientation. The same part of the heated sealing bar shall be used to bond each specimen to insure greater uniformity in the test results. A slip sheet made of No. 300PT cellophane shall be folded over each test specimen prior to sealing making a sandwich with the polyethylene pieces between faces of cellophane. This assembly is inserted in the sealer. The cellophane eliminates the sticking of the polyethylene to the heat sealing platens.

The tensile strength of the sealed test specimens shall be measured in accordance with 7.8 using a 2-inch grip separation. The type and place of break shall be noted. The results obtained with the five sealed specimens in each direction shall be averaged separately; thus giving two average results.

**7.12.4 Calculations.**—Calculate the average tensile strengths in pounds per square inch. A complete set of averages will consist of four values, two for the lengthwise direction and two for the crosswise direction. Two values will be for controls and two for seals made at 350 °F.

The coefficients of heat sealability (chs) for each orientation shall be calculated as follows:

$$\text{chs} = \frac{\text{average tensile strength of sealed specimens}}{\text{average tensile strength of control specimens}}$$

Coefficients higher than 1.00 are attributed to variations in the method and thus the increment above this value has no direct significance; therefore, values above 1.00 shall be reported as 1.00.

**7.13 Odor.**—The odor level of a polyethylene film shall be determined by smelling and comparing a polyethylene-film-odor control standard with specimens cut from the sample being tested, each of which has been sealed in a glass jar for a specified time under identical conditions.

**7.13.1 Apparatus.**—(a) Clean 1-pint mason jars with glass or glass-lined closures. Rubber or wax-coated tops shall not be used. These bottles shall be clean and free of odor. They shall be periodically washed in chromic acid cleaning solution and rinsed in distilled water.

(b) Clean and rust-free scissors, kept in an odor-impermeable container exclusively for the odor test.

(c) Clean white cotton gauze gloves.

(d) Two odor standards (see 6.9) for each panel member.

**7.13.2 Specimens.**—Spread the specimen on a clean odor-free table. In the case of film the side that was facing the center of the roll shall be up; in the case of tubing the inside of the tubing roll shall be up. Using the clean white cotton gloves cut from the sample sufficient specimens, each with an area of  $300 \pm 15$  in.<sup>2</sup>, so that each panel member can test one specimen. In the case of tubing cut the specimen open. Crumple each specimen before inserting it into the clean mason jars. Cut another piece of uncontaminated film from the same sample large enough to cover and overlap the open top of the jar by approximately one inch. Place this piece of film over the jar and close tightly. Treat specimens of the polyethylene-film-odor control sample in the same manner as the specimens of the sample being tested; two control specimens shall be prepared for each test specimen. Condition the test specimens and the standards for 4 hours at room temperature or as specified in 7.1 in an odor-free atmosphere. The jars with the test specimen and one-half of those with the controls will not be revealed to the members of the testing panel. The other half of the jars with the control specimens shall be marked to indicate that they contain control specimens.

**7.13.3 Procedure.**—The odor testing panel shall consist of 3 to 15 members. A panel of five members is recommended. The jars shall be distributed in a random order by a person not participating in the test, so that each panel member receives jars with one test specimen, one unmarked control, and one marked control. The jars shall be opened by the panel members who have previously washed and rinsed their hands thoroughly. The air in the jars shall be smelled and rated immediately, in accordance with 7.13.4. The marked control shall serve as the standard of reference. Only persons who can demonstrate that they can distinguish between different odor levels of polyethylene film shall be used as panel members. Persons suffering from colds or emotional upsets shall be excluded. Not more than 6 samples shall be rated at one time by a panel member. Approximately 30 minutes between two sessions is sufficient for sensory recovery.

**7.13.4 Method of rating.**—The film odor level shall be rated as either satisfactory or unsatisfactory when compared to the odor standard. A satisfactory rating means that the film odor level is

equal to or less than the odor standard. An unsatisfactory rating means that the film odor level is higher than the odor standard. The specimens shall be rated according to the five odor levels as follows:

Level 1—No detectable odor (less than standard)

Level 2—Slight odor (but less than standard)

Level 3—Acceptable odor (equal to standard)

Level 4—Moderate odor (more than standard)

Level 5—Objectionable odor (more than standard)

The total group rating for a five-member panel shall be expressed as:

**Satisfactory**—All ratings level 3 or less.

**Satisfactory**—Four level 3 ratings or less; one level 4 rating.

**Unsatisfactory**—Three level 3 ratings or less and two level 4 or 5 ratings. The level 4 specimens may be rerated by two new panel members, and if one or both specimens are rated as level 3 or less, the panel rating shall be changed to satisfactory.

**Unsatisfactory**—Four level 3 ratings or less and one level 5 rating. The level 5 specimen may be rerated by one new panel member, and if rated as level 4 or less, the panel rating shall be changed to satisfactory.

**Unsatisfactory**—Two or more level 5 ratings. Not eligible for rerating.

## 8. IDENTIFICATION

**8.1 Labels and Literature.**—In order that purchasers may be assured that the polyethylene film actually complies with all the requirements of this Commercial Standard, it is recommended that manufacturers include the following statement in conjunction with their name and address on labels, invoices, sales literature, etc.

This (Type, Grade, Class, or Finish of) polyethylene film complies with Commercial Standard CS227-59, as developed by the trade, under the procedure of the Commodity Standards Division, and issued by the U.S. Department of Commerce.

**8.1.1** The following abbreviated statement is suggested when available space on labels is insufficient for the full statement:

Complies with CS227-59, as developed by the trade and issued by the U.S. Department of Commerce.

**8.2 Hallmark.**—Polyethylene film may carry the hallmark shown in figure 8.2 to indicate compliance with this Commercial Standard.

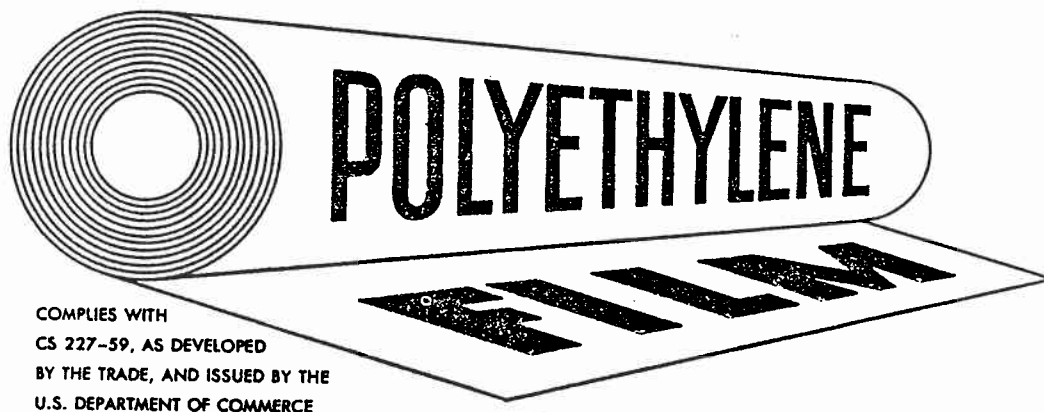


FIGURE 8.2.—Hallmark.

## **9. APPENDIX**

9.1 For films intended for packaging foods or drugs, it is recommended that attention be given to the Food Additives Amendment of 1958, administered by the Food and Drug Administration, Department of Health, Education and Welfare, Washington, D.C., 20201.

## **10. EFFECTIVE DATE**

10.1 Having been passed through the regular procedure of the Commodity Standards Division, and approved by the acceptors hereinafter listed, this Commercial Standard was issued by the United States Department of Commerce, effective November 15, 1959.

## **HISTORY OF PROJECT**

In a letter dated October 24, 1958, The Society of the Plastics Industry, Inc., requested the cooperation of the Commodity Standards Division in the establishment of a commercial standard for polyethylene film. The Society submitted as a basis for the standard a specification developed cooperatively, over a period of four years, by The Society of the Plastics Industry Polyethylene Film Division and the National Flexible Packaging Association.

The Commodity Standards Division distributed copies of the proposed Commercial Standard to representative producers, distributors, testing laboratories, users, and Government agencies for constructive comment. All comments received were considered by The Society of the Plastics Industry Polyethylene Film Division and adjustments were made to satisfy the comment wherever practicable.

Accordingly, the recommended Commercial Standard was circulated to the trade on February 18, 1959, for acceptance. Subsequent comment concerning the recommended standard was reviewed at a special meeting of the polyethylene film industry held at the National Bureau of Standards on September 17, 1959. Substantially all suggestions for modification were approved at the special meeting and the Commodity Standards Division was instructed to proceed with the promulgation of the standard providing acceptances were subsequently received from key organizations in the industry. Upon receipt of those acceptances the Division issued an announcement that the official acceptors represented a favorable majority of the polyethylene film industry, and that the Commercial Standard, designated CS227-59, would become effective November 15, 1959.

Project Manager: H. A. Bonnet, National Bureau of Standards, Office of Commodity Standards.

Technical Advisor: Dr. Frank W. Reinhart, Plastics Section, National Bureau of Standards.

## **STANDING COMMITTEE**

The following individuals comprise the membership of the standing committee, which is to review, prior to circulation for acceptance, revisions proposed to keep the standard abreast of progress. Comment concerning the standard and suggestions for revision may be addressed to any member of the committee or to the Office of

Commodity Standards, National Bureau of Standards U.S. Department of Commerce, which acts as secretary for the committee.

R. C. PHELPS, Polyethylene Film Division, U.S. Industrial Chemicals Co., Tuscola, Ill. (Chairman)  
E. S. ELGIN, Chase Bag Co., 355 Lexington Ave., New York, N.Y. 10017.  
DR. BEN P. ROUSE, JR., Eastman Chemical Products, Inc., Kingsport, Tenn.  
C. CHARLES PEARL, Equitable Paper Bag Co., Inc., 45-50 Van Dam St., Long Island City, N.Y. 11101.  
M. W. SULLIVAN, Gering Plastics, Dept. of Monsanto Chemical Co., North 7th St. & Monroe Ave., Kenilworth, N.J.  
R. A. MCCARTHY, Monsanto Chemical Co., Plastics Division, Springfield, Mass. 01102.  
JOHN M. COWAN, National Flexible Packaging Assoc., 11750 Shaker Blvd., Cleveland, Ohio 44120.  
JULES PINSKY, Plax Corp., P.O. Box 1019, Hartford, Conn.  
WALLACE B. TIBBETS, Container Dept., Union Carbide Plastics Co., Division of Union Carbide Corp., 17-01 Nevins Road, Fair Lawn, N.J.

### ACCEPTORS

The manufacturers, distributors, users, and others listed below have individually indicated in writing their acceptance of this Commercial Standard prior to its publication. The acceptances indicate an intention to utilize the Standard as far as practicable, but reserve the right to depart from it as may be deemed desirable. The list is published to show the extent of recorded public support for the Standard, and should not be construed as indicating that all products made by the acceptors actually comply with its requirements.

Products that meet all requirements of the standard may be identified as such by a certificate, grade mark, or label. Purchasers are encouraged to require such specific representation of compliance, which may be given by the manufacturer whether or not he is listed as an acceptor.

[Original list of acceptors—Acceptances received prior to November 15, 1959]

#### ASSOCIATIONS

(General Support)

Midwest Converters Association, Skokie, Ill.  
National Flexible Packaging Association, Cleveland, Ohio.

#### FIRMS AND OTHER INTERESTS

Acme Backing Corp., Packaging Materials Division, Stamford, Conn.  
Agricultural Specialty Co., Hyattsville, Md.  
Alcoa Research Labs., Foil and Packaging Division, New Kensington, Pa. (General Support).  
Allied Plastics Supply Corp., New York, N.Y.  
American Bag & Paper Corp., Philadelphia, Pa.  
American Hard Rubber Co., Division of Amerace Corp., Butler, N.J.  
Andmar Plastic Co., Inc., Clifton, N.J.  
Andmar Sales Inc., Clifton, N.J.  
Bemis Bro. Bag Co., Plastic Package Plant, Terre Haute, Ind.  
Campeo Division of Chicago Molded Products, Chicago, Ill.  
Carlon Products Corp., Aurora, Ohio.  
Celanese Corp of America (Plastics Division), Newark, N.J.  
Cello-Foil Products, Inc., Battle Creek, Mich.  
Cellu-Craft Products Corp., New Hyde Park, N.Y.  
Chaffee, Ralph, & Co., San Francisco, Calif.  
Chase Bag Co., Plastics Division, New York, N.Y.  
Chippewa Plastics, Inc., Chippewa Falls, Wis.  
Claremont Pigment Dispersion Corp., Roslyn Heights, Long Island, N.Y.

Clearprint, Inc., New York, N.Y.  
Continental Can Co., Inc., Flexible Packaging Division, Mount Vernon, Ohio.  
Crystal-X Corp., Lenni Mills, Pa.  
Deerfield Plastics Co., Inc., South Deerfield, Mass.  
Del Val Ink & Color, Inc., Pennsauken, N.J.  
Diaphane Corp., Philadelphia, Pa.  
Dobackmun Co., Division of Dow Chemical Co., Cleveland, Ohio.  
Dow, The Chemical Co., Midland, Mich.  
Eastman Chemical Products, Inc., Kingsport, Tenn.  
E. I. du Pont de Nemours & Co., Inc., Film Dept., Wilmington, Del.  
Equitable Paper Bag Co., Inc., Long Island City, N.Y.  
Extrudo-Film Corp., Long Island City, N.Y.  
Firestone Plastics Co., Division of The Firestone Tire & Rubber Co., Pottstown, Pa.  
Flexicraft Industries, Inc., New York, N.Y.  
Fortune Plastics, Inc., Westbrook, Conn.  
Fox Plastics Consultants, Swarthmore, Pa.  
Gering Plastics, Division of Studebaker-Packard Corp., Kenilworth, N.J.  
Goodrich-Gulf Chemicals, Inc., Cleveland, Ohio.  
Grace, W. R., & Co., Polymer Chemicals Division, Clifton, N.J.  
Hudson-Sharp Machine Co., Green Bay, Wis.  
Industrial Nucleonics Corp., Chemical Industries Division, Columbus, Ohio (General Support).  
Interchemical Corp., Color & Chemical Division, Bound Brook, N.J.  
Joanna Western Mills Co., Chicago, Ill.  
Kal Plastics, Inc., Beaverton, Mich. (General Support).  
Kendall Co., The, Chicago Division, Chicago, Ill.

<p>Kennedy Car Liner &amp; Bag Co., Inc., Shelbyville, Ind.          Keystone Packaging Service, Easton, Pa.          Koppers Co. (Durethane Plant), Chicago, Ill.          Kordite Corp., Macedon, N.Y.          Ludlow Papers, Inc., Plastics Division, Needham Heights, Mass.          Mason Envelope Co., Inc., New York, N.Y.          Milprint, Inc., Milwaukee, Wis.          Monsanto Chemical Co., Springfield, Mass.          Nashua Corp., Nashua, N.H.          National Foli Co., Elizabeth, N.J.          Olin Mathieson Chemical Corp., Film Division, Pisgah Forest, N.C.          Owens-Illinois Glass Co., Toledo, Ohio.          Package Engineers, Inc., Oklahoma City, Okla.          Packaging Center, The, Frederick, Md.          Packaging Industries Limited, Inc., Montclair, N.J.          Paper Trading Corp. of Worcester, Worcester, Mass.          Pexco Bag Manufacturing Co., Toledo, Ohio.          Phoenix Products Co., Milwaukee, Wis.          Plastic Horizons, Inc., Paterson, N.J.          Plastic Packaging Co., Chicago, Ill.          Plax Corp., Bloomfield, Conn.          Poly Plastic Products, Inc., Patterson, N.J.          Protective Lining Corp., Brooklyn, N.Y.          Queen Transparent Specialties Co., Chicago, Ill.          Reliance Plastic &amp; Chemical Corp., Paterson, N.J.          Robert Corp., Lawrence, Mass.          Rochester Dairy Cooperative, Rochester, Minn.          Roto Bag Machine Corp., New York, N.Y. (General Support).          St. Regis Paper Co., Chester Packaging Products Division, Yonkers, N.Y.</p>	<p>Seiberling Rubber Co., Plastics Division, Newcomerstown, Ohio.          Spencer Chemical Co., Plastics Division, Kansas City, Mo.          Stormvelope Co., Bethesda, Md.          Tomah Products, Inc., Tomah, Wis.          Transpak, Inc., Hialeah, Fla.          Trans-Poly Corp., Mount Vernon, N.Y.          Trimount Plastic Co., Inc., Arlington, Mass.          Union Transbag Co., Providence, R. I.          U.S. Industrial Chemical Co., New York, N.Y. (General Support).          United States Testing Co., Inc., Hoboken, N.J.          Visking Co., Division of Union Carbide Corp., Chicago, Ill.          Waljohn Plastics, Inc., &amp; Rotuba Extruders, Brooklyn, N.Y.          Wasco Flashing Co., Inc., Cambridge, Mass.          Western Tablet &amp; Stationery Co., St. Joseph, Mo.          Wraps, Inc., New York, N.Y.          Wright Plastics Co., Chamblee, Ga.</p>
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#### U.S. GOVERNMENT

Atomic Energy Commission, Property and Supply Management Branch, Division of Construction and Supply, Washington, D.C.  
 Coast Guard, Washington, D.C.  
 Health, Education, and Welfare, Department of Procurement and Supply Management Branch, Washington, D.C.  
 Interior, Department of, Office of the Secretary, Division of Property Management, Washington, D.C.  
 Veterans Administration, Washington, D.C.

#### SUPPLEMENTARY LIST OF ACCEPTORS

[Acceptances received November 15, 1959, to March 31, 1964]

Aladdin Transparent Packaging Corp., Westbury, N.Y.  
 Continental Extrusion Corp., Brooklyn, N.Y.  
 Continental Plastics Corp., St. Paul, Minn.  
 Crystal Tube Corp., Chicago, Ill.  
 Favorite Plastic Corp., Brooklyn, N.Y.  
 Flexographic Chemical Co., Inc., Hawthorne, N.J.  
 Food Film, Inc., Pine Brook, N.J.  
 General Industrial Container Corp., Chester, Pa.  
 Globe Extruders, Inc., Brooklyn, N.Y.  
 Lion Packaging Products Co., Inc., Hicksville, N.Y.  
 Mehl Manufacturing Co., Cincinnati, Ohio  
 Packaging Products & Design Corp., Newark, N.J.  
 Pak-All Products, Providence, R.I.  
 Phillips Chemical Co., Plastics Sales Division, Bartlesville, Okla.  
 Poly Print Bag Corp., Brooklyn, N.Y.  
 Printon Corp., New York, N.Y.  
 Supermart Packaging Co., Inc., Philadelphia, Pa.  
 Tower Packaging Co., Skokie, Ill.

#### OTHER COMMERCIAL STANDARDS

A list of Commercial Standards (LP 53) may be obtained from the National Bureau of Standards, Office of Commodity Standards, Washington, D.C., 20234. This list includes the purchase price of the publication and directions for ordering copies.

USCOMM-NBS-DC